



# The Impact of BART on Land Use and Urban Development

Interpretive Summary of the Final Report

December 1978

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a report by the Metropolitan Transportation Commission



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The Metropolitan Transportation Commission was established by California law in 1970. Its 19 members represent city and county governments and federal, state and regional agencies that deal with transportation and urban development in the nine counties of the San Francisco Bay Area. MTC's duties include:

- preparing, periodically revising and implementing a regional transportation plan that serves the present and future needs of the nine counties;
- reviewing requests by Bay Area agencies for transportation funds from the state or federal government;
- monitoring the effectiveness and performance of the Bay Area's transit operators.

As a part of its transportation-planning effort, MTC undertook the study of BART that is described in this report. The report is distributed under the sponsorship of the U.S. Department of Transportation and the U.S. Department of Housing and Urban Development. The United States Government and MTC assume no liability for its content, or for the use made thereof.

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## Introduction and Abstract of Findings

BART — the Bay Area Rapid Transit System — is a commuter-oriented rail system that serves three counties on San Francisco Bay. It began operating in September 1972. In mid-1978, BART's average weekday patronage was about 146,000 one-way trips a day, and the BART staff expects it to reach 180,000 trips by 1981.

In 1972, the Metropolitan Transportation Commission began the BART Impact Program — a study of BART's effects on the people, the communities and the region that it serves. The program was completed in December 1978.

One of the six major elements in this policy-oriented program was the Land Use and Urban Development Project, which is described in this report. The project analyzed BART's effects on the spatial distribution of construction and on other aspects of urbanization: workplace and residence selections, development decisions, shopping patterns, retail sales, land use near BART stations, real-estate speculation, and property prices and rents.

Other projects in the BART Impact Program dealt with BART's effects on the environment, on travel behavior, on institutions and lifestyles, on public policy and on economics and finance.

The results of these analyses, it is hoped, will help planners and public officials make informed decisions about rail transportation systems in the Bay Area and in other regions.

This summary describes BART's setting, presents the principal findings and conclusions of the Land Use and Urban Development Project, and discusses implications of the BART experience for other metropolitan areas where rail rapid-transit systems are being planned or built. This report has been written for public officials and others who share an interest in urban transportation systems. Technical details of the Project and the subjects that it studied appear in the reports listed in Section 12.

Here is an abstract of the Project's major conclusions about BART's effects on land use, the effects that it might have in the future, and the implications of these findings for other regions.

### **BART'S Effects on Land Use**

BART has influenced land use and urban development in the Bay Area directly (through its service and its physical effects) and indirectly (through its impacts on zoning regulations, redevelopment finances, and civic improvements). Its effects to date have been small, but not inconsequential.

BART has had some effect on both commercial and residential construction, and it is becoming a factor in location decisions by employers and by households.

BART has been less influential in the sphere of retail activity. Retailers largely disregard BART in their location decisions. Sales data indicated no advantage for stores near BART stations, although 6 merchants (out of 33 interviewed) thought that their locations near BART stations promoted their sales. People ride BART to downtown shopping districts and outlying retail areas, and survey data suggest some shifting in shopping patterns toward areas served by BART.

BART has had small effects on residential and commercial property prices and rents, inducing increases in some areas and decreases in others.

On a regional scale, BART has not had a measurable impact on population or employment; but development in BART corridors and in downtown areas has been somewhat greater than it would have been if BART hadn't been built.

BART has worked with other forces to affect the individual location and investment decisions that shape urban development patterns. BART clearly has been an important stimulus for redevelopment plans, urban beautification projects and some changes in zoning policies. BART hasn't increased the amount of private development that has occurred, nor has it rejuvenated declining neighborhoods; but it has, with other public projects, shifted demand for development from one area to another.

Many anticipated impacts of BART have not been realized. For example, high-density residential development hasn't occurred in BART station areas. There are several possible explanations for this: for many trips, BART is only marginally faster than alternative public transit, and is slower than travel by automobile. At some places, high-density construction was prohibited by zoning regulations. At others, there was little demand for high-density development, and there was space for new, lower-density residential buildings in the same local market.

### **Expectations for the Future**

As BART implements its plans for increased service and improved reliability, its patronage will increase and it will have a greater influence on location decisions. This effect will be amplified by any trends that make highway travel less attractive.

As BART's patronage increases, BART might have more influence in reinforcing the commercial centers of

downtown Oakland and San Francisco. And by demonstrating a public commitment to the central cities, BART might encourage private investment in those cities.

Diminishing supplies of undeveloped land and other economic factors will increase the demand for multifamily housing. Several BART station areas are good candidates for such development.

Even with a doubling of patronage, however, these effects will not be as dramatic as those once expected. BART is only one of the factors that affect land use, and the opportunities for change are limited.

The most visible effects will occur near downtown stations and near other stations where surrounding land is vacant and amenable to development.

### Implications for Other Regions

The land-use impacts of a rapid transit system are greatest where other influences also encourage development — zoning, public redevelopment, strong market demand, land supply and community support.

In suburban communities and residential neighborhoods, rail transit will not induce high-density housing around stations unless the demand for such housing is strong, station sites are available and appropriately zoned, and alternative sites are limited.

During planning, local governments should work with developers, financial institutions and citizens' organizations to coordinate land-use and transit plans. But they should expect that most developers will not undertake any building until service has begun, unless there is a strong independent demand, as there was for office space in downtown San Francisco while BART was being built.

A value-capture policy — one that expects increases in property values in the vicinity of rapid-transit stations, and corresponding increases in property-tax revenues — is unlikely to yield substantial revenues early in the life of a system.

Parking requirements and alternative modes of access (such as feeder buses) require attention early in the planning process, if the adverse effects of overflow parking are to be avoided.

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# 1 BART and Its Setting

## BART's Setting

The BART District comprises three counties that have a developed or developable area of 460 square miles. The City and County of San Francisco has been fully developed since the 1960's. Alameda County was two-thirds developed by 1975, and Contra Costa County was about one-half developed. The three counties had a combined population of 2.4 million in 1970. In 1975, about 1 million people lived within 1 mile of BART trackways. BART enters or traverses 14 cities and several unincorporated areas.

Development patterns in the San Francisco Bay Area are shaped by San Francisco Bay and its surrounding hills. North-south corridors of urban development extend along both sides of the Bay, and a corridor runs eastward from Berkeley into the central part of Contra Costa County.

Before World War II, urban growth had been concentrated in San Francisco, Oakland, Berkeley, and Richmond — the older cities on the shores of the Bay. During the past 25 years, development has become more dispersed and suburban communities have grown dramatically. New, rapidly growing areas within the District include southern Alameda County and central Contra Costa County.

The Bay Area's total employment in 1975 was a little more than 2 million. The three BART counties accounted for 53 percent of that total, while Santa Clara County and San Mateo County represented 36 percent.

## The BART System

**Configuration** BART's four lines radiate from downtown Oakland. The lines are named for their termini: The Richmond line, the Concord line, the Fremont line, and the Daly City line. All of the lines pass through older, medium-density residential and industrial areas; the Concord and Fremont lines extend into newer, lower-density suburbs. The 71-mile system includes 20 miles of tracks in subway tunnels, 24 miles on elevated structures, and 27 miles at ground level. The subways include the Transbay Tube, a tunnel through the hills east of Oakland, and sections in downtown Berkeley, Oakland and San Francisco.

About 85 percent of BART's trackways lie within, beside or below the rights of way of other transportation routes — arterial streets, highways or other railroads.

In the commercial centers of San Francisco and Oakland, BART provides local subway service. Its stations there

are 0.3 to 0.5 miles apart. In the suburbs, where stations are 2 to 4 miles apart, BART serves as a commuter railway.

**Stations** There are 34 stations in the system, and 23 of them have parking lots. The lots provide about 20,000 spaces; capacity at individual stations ranges from 240 to 1,600 cars. BART and other transit agencies provide bus service to all stations.

**Coordinated Development** During BART's construction, several cities carried out municipal-improvement projects that were coordinated with work on BART. These improvements included the development of plazas and pedestrian malls, and the refurbishing of important downtown streets. The redevelopment of Market Street in San Francisco is a noteworthy example. Other examples can be seen in Berkeley and Oakland.

**Train Operations** BART was opened in five stages, from September 1972 to September 1974. The last section to open was the Transbay Tube linking Oakland and the East Bay with San Francisco and the West Bay.

Between 6:00 AM and 6:00 PM on weekdays, trains run between Concord and Daly City, between Fremont and Daly City, and between Richmond and Fremont. The minimum headway (time between successive trains) on all three routes is 12 minutes. Where two routes converge (as in San Francisco) the minimum headway is 6 minutes.

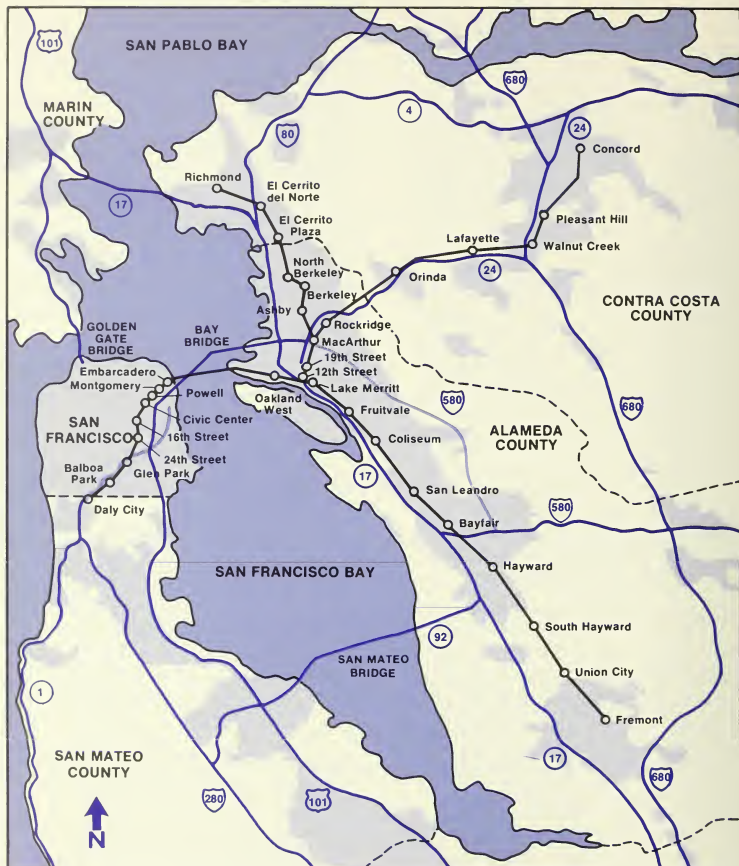
On weekday evenings (6:00 PM until midnight), trains run on two routes only: between Concord and Daly City, and between Richmond and Fremont. The minimum headway during the evening is 20 minutes.

Trains run on these same two routes on Saturdays from 6:00 AM until midnight and on Sundays from 9:00 AM until midnight. The minimum headway on Saturdays is 15 minutes; on Sundays, 20 minutes.

BART plans to expand its service significantly during the next two years by starting direct service between Richmond and Daly City, and by increasing the frequency of trains on all lines during peak-travel periods.

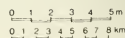
**Fares** Fares range from \$0.25 to \$1.45, depending upon trip length. Discount fares are available to the physically handicapped, children, and persons aged 65 and older.

**Ticketing** Tickets dispensed by vending machines carry magnetically coded values as high as \$20.00. Fare gates are operated by inserting a ticket. An exit gate computes the fare for a trip and deducts it from the ticket value.



- urbanized area
- federal highway
- interstate highway

- state highway
- BART
- BART station





**Station Interiors** BART stations show high standards and individuality of design, enhanced by the use of distinctive materials and works of art. The stations are notably quiet. Noise levels generated by arriving and departing trains are low in comparison with current standards of the rapid-transit industry.

**BART Trains** A BART car is 70 feet long and has 72 seats. Trains are from 3 to 10 cars long. Their maximum speed in normal operations is 70 miles an hour. The average speed is 38 miles an hour, including station stops. Each train stops at all stations on its route.

The cars are attractive and comfortable. Their interior features include air-conditioning, carpeting, tinted window glass, upholstered seats, and a public address system for announcement of stations and transfers.

## 2 Studying BART's Impacts

The Land Use and Urban Development Project was designed to determine how BART has influenced location decisions and development patterns, and to identify the socioeconomic consequences of these effects.

The Project was conducted for MTC by John Blayney Associates and David M. Dornbusch and Company, Inc., in a joint venture. It was supported by the U.S. Department of Transportation and the U.S. Department of Housing and Urban Development.

### The Impact Process

In this study, the impact process was assumed to work thus:

BART, by its construction and operation, affects the transportation system and the environment within which it operates. If the transportation system that includes BART provides faster, more convenient or less costly transportation than the system that existed before BART was built (or the system that might have evolved if BART hadn't been built), it affects people's decisions about where to live and work. Hence it affects patterns of urbanization.

One reason for this is that people consider the amenities of a site, including transportation service, when making location decisions. New amenities, such as a new transit system, increase a site's desirability for some businesses or for some people who otherwise might choose to live, to shop, or to work elsewhere.

On a regional scale, cities with BART service might attract some activities at the expense of cities not served by

**Capital Cost** The cost of building and equipping BART was \$1.6 billion.\* Half of this amount was raised through the sale of general-obligation bonds by the BART district. The bonds are serviced by revenue from a local property tax. Sources for the rest of BART's capital included a 0.5% tax on retail sales in the three BART counties, revenue from bridge tolls and capital grants by the Federal government.

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\*About 10% of this was the cost of the MUNI-Metro project in San Francisco — a \$160-million modernization of streetcar lines operated by the San Francisco Municipal Railway (MUNI). This project, which is scheduled for completion next year, has included the construction of tunnels (3.2 miles long) and underground stations. MUNI-Metro will share concourses with BART's Embarcadero, Montgomery Street, Powell Street and Civic Center stations. The 1.7-mile MUNI-Metro tunnel that connects these four stations is immediately above the corresponding BART tunnel.

BART. On a local scale, BART might attract some activities to station areas from other places in the same city.

### Research Questions and Methods

The Project's analysis of BART's land-use effects covered the following subjects:

- Effects on location of activities: How does BART affect people's decisions about where to live, to work, and to shop?
- Effects on real-estate operations: How does BART affect people's decisions about where to build new houses, offices, and stores? Is there increased demand for sites near BART? If so, has this demand been reflected in higher prices or rents?
- Effects on socioeconomic groups: Do BART's effects on location decisions differ according to the age, the income, or the ethnic background of the people who make the decisions? Have BART's land-use impacts affected minority groups?
- Effects on urban development patterns: Does BART tend to reinforce the older, centralized patterns, or does it encourage decentralization?

The Project's research methods included surveys, observations of past and present land uses, statistical analysis of primary and secondary data, review of contemporary news reports, and detailed case studies. All of the surveys mentioned in this report were done as parts of the BART Impact Program.

### 3 Impacts of BART's Construction

During the building of BART, the BART District acquired land and displaced some businesses and households. BART uses some 1,100 acres of land — about 26 square feet for each passenger-mile of service that it provided in 1977. Travel by auto, bus, and truck in the BART service area required about 53 square feet per passenger-mile in 1977.

Because so much of BART is within or adjacent to freeway and railroad rights-of-way, the displacement of households and businesses was relatively small. More than 60% (625 acres) of the land that BART bought was undeveloped or already was being used for transportation purposes. Only 26% (271 acres) was in residential use. The rest was in commercial or industrial use.

About 20 percent of BART's total acquisition was required for parking lots; the balance was for stations, yards, and rights-of-way. Rights-of-way rarely exceeded 75 feet in width. (By contrast, an eight-lane freeway requires a right-of-way at least 170 feet wide).

#### Displacement of Residences and Businesses

Some 3,000 housing units were moved or demolished for construction of BART's stations and lines. Nearly 600 buildings were moved; some even were barged to Stockton, in California's Central Valley. Altogether, 7,000 to 8,000 people were displaced, including those affected by the widening of freeways to accommodate BART tracks on freeway medians. Compared with the dislocation caused by some other transportation projects, this displacement was small. For example, a 3.5-mile segment of Highway 24 in Oakland displaced 3,000 households and numerous small businesses. All but 100 of the households would have been displaced even if there had been no BART trackway on this segment's median strip.

There are no data that tell explicitly the number of commercial enterprises that were displaced by BART, but local records show that more than 400 of the parcels that BART acquired had been in commercial or industrial use. This is the best available estimate of the number of business that were moved to make room for BART.

Surplus properties (land obtained as part of a parcel, but not needed for BART itself) have been rented on short-term leases, transferred to other agencies, sold to owners of adjacent property, or offered at public auctions. Under California law, a transit district can participate in joint corridor-planning work, but it cannot become an active developer. The responsibility for deciding how surplus properties should be used rests with local governments, not with BART.

#### Impacts of Subway Construction

The impacts of subway construction on nearby residents and businesses were minor where tunneling was used; they were significant where cut-and-cover construction was used in the central cities.

The duration of such work ranged from 2 years in downtown Berkeley to 5 years in San Francisco, where BART construction was compounded by street-beautification and other work. The construction disrupted traffic and reduced parking space; sidewalks were cramped by construction equipment and debris, and in some places were removed and replaced by temporary wooden walks. Retail sales within 400 feet of cut-and-cover sites fell by 2 to 4% (in 1967 dollars) as shoppers went elsewhere.

BART's construction activity did not impede the maintenance or rehabilitation of nearby property. Nor did it delay other construction in most places. Some possible exceptions were found in Oakland.

#### Community Reaction

Community reaction to BART varied greatly.

In San Francisco, a rezoning study examined ways of confining downtown high-rise construction to the station areas and the Market Street corridor. Concurrently, a Market Street beautification project was undertaken, and an additional BART station was planned, to serve projected office development east of the financial district.

In downtown Richmond and downtown Oakland, public redevelopment projects near BART stations were expanded and modified with BART in mind. Local officials expected that BART would increase demand for downtown office space, lure shoppers back to the city, and generate a market for downtown high-density housing.

In other areas, similar expectations about BART's effects provoked community opposition. In San Francisco's Mission District and Oakland's Rockridge District, where there were strong preservationist sentiments, fears of BART-induced development prompted citizens to organize successfully against permissive zoning regulations in station areas. As a consequence, zoning ordinances were amended to restrict development in these neighborhoods.

#### Effects on Neighborhoods

Two adverse effects of BART are especially relevant to studies of its impacts on land use. These effects are train noise and overflow parking.



Train-noise problems occur along about 10% of BART's trackways — chiefly near elevated sections in residential neighborhoods. These problems are confined to a narrow band (about two blocks wide), but are significant to many persons whose homes are affected. Although BART trains are quieter than most other rapid-transit trains in use, their high speeds combine with the sound-transmission qualities of elevated trackways to generate sound that exceeds background levels in quiet neighborhoods.

Overflow parking at suburban stations in residential neighborhoods is BART's worst continuing environmental

effect. Access to BART stations is dominated by the automobile everywhere but in city centers, because patrons prefer to drive and because suburban feeder-bus service is often inadequate. Overflow parking is especially severe at terminal stations, where patrons are drawn from large outlying areas.

BART has expanded the parking lot at its Fremont station, and has built a multi-level parking structure at the Daly City station. These measures have alleviated parking problems at those two sites, but BART planners continue to regard access as a severe long-term problem.

## 4 BART's Impacts on Travel Times

The Land Use and Urban Development Project's hypothetical BART-impact process (described in Section 2 of this report) assumed that BART has affected urbanization by making transportation faster, less costly or otherwise better. To determine whether BART has in fact improved transportation service, the BART Impact Program studied the travel times required for selected journeys within BART's greater service area.

### Basis for Calculating Travel Times

BART's greater service area was defined as the three BART counties plus the northern part of San Mateo County. About 96% of BART's patrons begin their trips at places within this area.

BART's aggregate effects on travel times in the greater service area were analyzed by calculating the time required to make hypothetical trips in two ways:

- using the with-BART public-transportation system — an approximation of the transit network, including BART, that actually existed in 1976;
- using a hypothetical no-BART transportation system — an approximation of the system, including public transit and highways, that might have existed in 1976 if BART hadn't been built.

The hypothetical no-BART system was developed because a simple comparison of conditions in 1962 (before BART was built) and 1976 (after BART was built) would have been misleading. The Bay Area's public-transit network wouldn't have remained unchanged for 14 years if the voters hadn't approved BART.

A careful historical study of economic and political decisions suggested that, if BART hadn't been built, the Bay Area would have had in 1976 a public-transit network much like the one that actually was operating there in

1973. Hence the 1973 network, with some minor changes, was used as the transit component of the no-BART system. This component, which consisted chiefly of local and express buses, would have provided less service and less capacity than the with-BART system provided in 1976; and it would have attracted fewer patrons.

The highway component of the no-BART system was assumed to be the same as the highway network that existed in 1976.

### Travel-Time Comparisons

During peak-travel periods, the with-BART system was faster than the transit component of the no-BART system for most of the trips that were studied.

For travel to 50 major centers of employment in the greater service area, the average with-BART trip was 5 minutes (12%) shorter than the average no-BART trip. The results for off-peak trips to shopping areas were similar. The with-BART advantage was greatest for trips from outlying suburbs to destinations in central Oakland, Berkeley and San Francisco.

But with-BART travel is generally and markedly slower than travel by automobile. For journeys to the same 50 centers of employment, the average automobile trip was 14 minutes (34%) shorter than the average with-BART trip.

The times required for with-BART travel and for automobile travel were comparable only for long trips between distant suburbs and central Oakland, Berkeley and San Francisco.

These findings demonstrate that BART is most effective when it is serving its primary purpose: carrying commuters on long trips between their homes in the suburbs and their jobs in urban centers.

## 5 BART's Impacts on Location Decisions

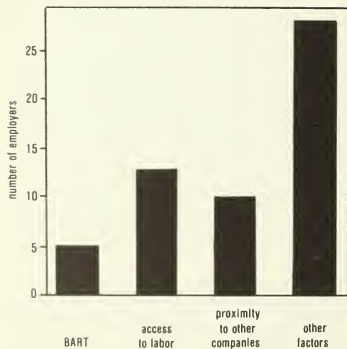
### Impacts on Employers' Decisions

Public transportation in general and BART in particular were found to be minor factors in most employers' location decisions. Among 71 informants representing 50 employers, 13 noted that access to the labor force was considered in location decisions; but this typically ranked lower in importance than site availability, cost, or proximity to other companies in related businesses.

BART's demonstrably small influence on these decisions undoubtedly reflects the fact that BART represents only a marginal improvement in a highly developed regional transportation system. Nevertheless, 5 major employers among the 50 contacted said that their decisions had been affected directly by BART. Three of these employers were government agencies; the others were large companies. All the locations that they chose are in the older cities (Oakland, San Francisco and Richmond).

Banks and savings-and-loan companies attempt to anticipate development trends in deciding where to locate. Although they were aware that BART might influence growth, none of seven financial institutions contacted had specifically located new branches in anticipation of BART.

With one exception (the Social Security Administration's Western Program Center in Richmond), major em-



The minor influence of BART on location decisions by employers. Among 50 major employers that were contacted during a survey in 1976 by the Land Use and Urban Development Project, only 5 had considered BART service during the selection of new sites.

ployers have not been drawn to station areas in economically depressed areas, such as Richmond and parts of Oakland. This indicates that, without existing demand for new commercial space, a new transit system won't induce much new commercial development.

At the regional level, there is no evidence of BART's influencing either centralization or decentralization of business districts. Only the Social Security Administration cited BART among its reasons for moving to a "less central" location — from San Francisco to Richmond.

On the other hand, interviews suggest that BART had encouraged some companies not to move, and that BART thus might have had some effect in maintaining the eminence of the Bay Area's traditional city centers.

### Impacts on Workers' Decisions

Ordinarily, an individual does not choose a job because of its location. During a 1977 survey, fewer than 10% of the people who worked near BART stations stated that transportation had been a factor in their job choices. Implicit in this result is the fact that most people have acceptable modes of transportation to most workplaces.

Nonetheless, the desirability of a job can depend on the accessibility of the workplace to BART. In one sampling of people who recently had changed or obtained jobs, 25% of the respondents said that they had sought their new jobs with the intention of commuting by BART. (Since this sample had been chosen so that half of the respondents were BART patrons, the results undoubtedly overstated BART's influence). BART's importance was greatest among San Francisco workers who lived in the East Bay: 57% cited BART as a consideration in their job choices, though only 40% of those who gave this answer actually travelled by BART.

BART's importance in job choice was found to be greater among workers under 40, but it didn't vary according to income, sex, race or ethnic background.

BART is used by many people in looking for work. One-third of the respondents to the 1977 survey had used BART at least once to travel to job interviews.

The most common reasons for not using BART were that the system was inaccessible from home and that the service, including feeder service and train schedules, was not good enough.

To many suburban commuters, BART might represent a transportation option that they will exploit if free-

way congestion becomes intolerable or gasoline shortages curtail automobile use. This interpretation is supported by the finding that suburban homeowners were more likely to seek homes near BART than renters were. Since home-owning involves a considerable investment, owners are more likely to consider long-term prospects when they choose a residence.

### Impacts on Retailers' Decisions

Factors that affect access to customers are critical in the location of a retail business, so transportation consistently ranks high among the considerations in site selection. Despite this fact, interviews with individuals whose retail and service businesses are near BART stations showed that BART had been a minor factor in location decisions.

Once again, BART's negligible impact seems due to the fact that other transportation forms predominate — buses in urban areas and automobiles in the suburbs. In San Francisco, where bus and trolley lines funnel into Market Street, a site near BART usually enjoys good bus and trolley-car service too. As a result, specific BART impacts are hard to detect.

### Impacts on Shoppers' Decisions

Besides taking BART to work, people ride BART to downtown shopping districts and outlying retail areas. A survey of 500 shoppers (weighted so that half of the respondents were BART-riders) indicated that BART might

have been influencing shopping patterns. One out of every four shoppers who had increased their use of a BART-served shopping area since 1974 cited BART as the reason for the increase.

The shift in shopping patterns suggested by the survey favors downtown San Francisco, downtown Oakland, and Walnut Creek. In all three places, "new" shoppers (those who had traded there only since 1974) showed a significantly higher propensity to use BART for shopping than did others. In Walnut Creek and San Francisco, about 45% of the new shoppers (and 7% of all the shoppers surveyed) said that BART was their reason for shopping in those places.

The survey results show that BART is used more often for personal errands (such as medical appointments and banking) than for shopping, and more often in shopping for light household items, gifts, and personal items than in shopping for bulky items such as appliances.

### Impacts on Retail Sales

A few merchants said that proximity to BART stations had improved their sales. About 18% of the merchants questioned in 11 shopping districts believed that BART was helping sales. The others discerned no impact. Data from 1970 to 1976 on taxable retail sales of stores in downtown San Francisco, Oakland, and Berkeley provide no evidence of a positive relationship between proximity to BART and growth in sales. Analyses of retail sales in other shopping areas were inconclusive.

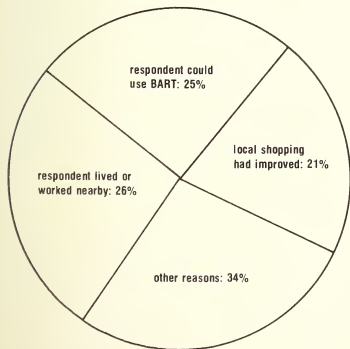
### Impacts on Housing Construction

BART has affected the housing industry to some extent, and the impacts have been different from those that planners originally expected. For example, no nodes of high-density development have materialized near stations. Several explanations may be offered for this.

At Rockridge, residents reacted to forecasts of BART-induced growth by forming a neighborhood organization that fought successfully for new zoning regulations that bar high-density land uses. Regulations that limit the intensity of new residential development were passed in eight other areas as well.

But several suburban communities deliberately zoned land near BART stations for high-density development. Reasons for the lack of development at these sites include suburban residents' preference for single-family homes and their undiminished reliance on automobiles, both for commuting and for casual travel.

Interviews with developers indicated that BART has promoted demand for housing at Pittsburg and Antioch in



**BART's importance in shoppers' decisions.** This graph is based on a 1977 survey of 500 shoppers, conducted by the Land Use and Urban Development Project. It shows reasons that respondents cited for their increased use of shopping areas served by BART.

north-central Contra Costa County, and at Union City and Fremont in southern Alameda County. New residential development probably would have occurred in those places without BART, given the scarcity of developable land near the major cities, the continued demand for single-family dwellings and the completion of several major highway projects. But BART might have accelerated development by increasing the accessibility of these areas to employment centers.

BART appears to have had a marked impact on developers' decisions. Two-thirds of the 26 developers interviewed said that BART was a "somewhat important" factor in their decision-making, and half stated that they would pay more for developable land near a BART station. (There was no way to test these assertions). Six large projects totalling 3,500 units were identified whose location, timing, or density had specifically taken BART service into account.

Near certain at-grade and elevated trackways, BART noise has discouraged residential development. Example: A 2-mile stretch of vacant land near Fremont seems suited for housing, but it has seen no development. Representatives of five major developers said that their decisions not to build on this land were influenced by the noise impacts of BART and the consequent cost of soundproofing required by law.

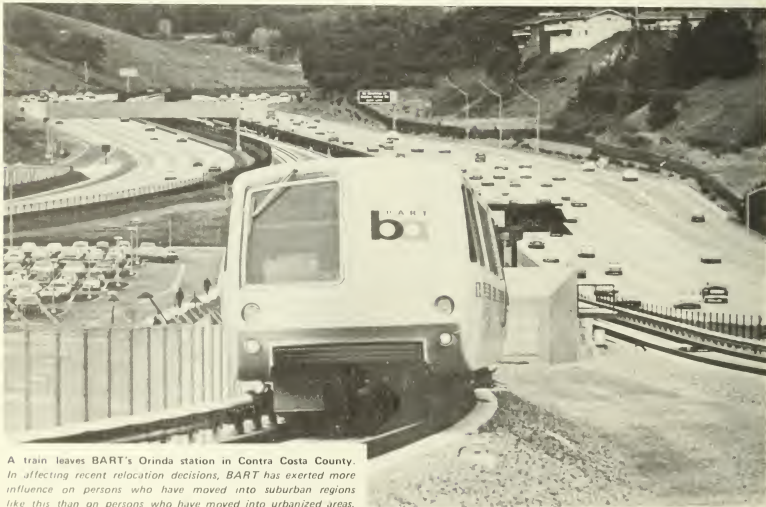
## Impacts on Households' Decisions

A survey of 300 persons who recently had moved found that BART had had virtually no influence on their deciding *whether* to relocate.

But BART often was considered when people decided *where* to relocate. Half of the survey respondents considered access to BART in their selection of a place to live. Nearness to BART typically ranked sixth to tenth, after considerations such as housing type, general access to workplace, and neighborhood characteristics. One in five respondents expressed a willingness to pay more for a residence near BART.

BART's importance in decisions about where to live increases as travel time increases. Hence BART has had a greater effect on people who have moved to or within suburban areas than on people who have moved to urban areas. And since people with low incomes are more likely to find housing in the inner cities than in the suburbs, low-income individuals considered BART less frequently than did high-income or middle-income respondents.

BART exerts a slight, indirect influence on household location decisions through its impact on job locations: persons who work near BART may choose to live near BART, for easy commuting.



A train leaves BART's Orinda station in Contra Costa County. In affecting recent relocation decisions, BART has exerted more influence on persons who have moved into suburban regions like this than on persons who have moved into urbanized areas.

## 6 BART's Impacts on Development Decisions

Most of the new development near BART stations has been commercial or institutional, rather than residential. There are several reasons for this:

- Four cities enacted zoning changes that encouraged commercial construction near stations, while nine communities changed their zoning to preclude intensive residential development in station areas.
- To benefit from BART, commercial buildings must be within walking distance of a station. Housing can benefit at greater distances, especially if the local BART station includes a parking lot.
- In some suburban areas, the demand for high-density residential units is poor, even though land is available and appropriately zoned for such units.

### Impacts on Office Construction

A review of building permits showed that suburban communities served by BART have increased their share of new office construction markedly — from 6% during the years 1963 to 1965 (the years immediately before the construction of BART began) to 14% in the years 1974 to 1976 (immediately after the completion of BART's last major section).

Rapid population growth and the availability of land at favorable prices appear to be the forces behind the suburban office expansion. Since only minor increases in the suburban population can be attributed to BART, its indirect influence on office construction in these communities has been minimal. BART seems not to have induced any offices to locate in the suburbs rather than in the central cities.

San Francisco and Oakland's share of regional office construction declined from 91% in the early 1960s to 83% in the mid-1970s. But in terms of the value of new office buildings, the two cities witnessed 140% more construction in the mid-1970s than in the early 1960s. BART played no discernible role in stimulating this continuing vigorous growth of office space in city centers.

Interviews with representatives of six companies that were moving or recently had moved to San Francisco or Oakland indicated that the moves were unrelated to BART.

Informants in San Francisco were unable to identify any recent office construction that had been attracted to that city specifically because of BART. But BART has helped to influence the location of new office buildings within the city. Most new development in San Francisco

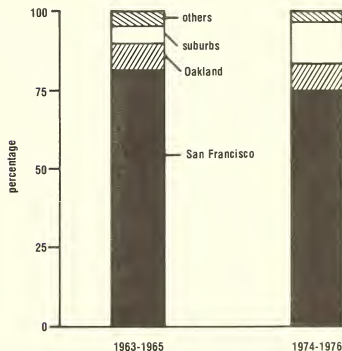
has occurred on or near Market Street. As a result, the Market Street area — formerly a deteriorating district — has increased its share of new office construction from virtually none in the years 1960-1962 to 88% in the years 1974-1977.

BART *directly* affected the location of seven major projects that have been built along Market Street since 1965. These projects represent about 10% of the new construction along Market Street during the past 13 years.

BART also has had an *indirect* influence on the location of new office construction near Market Street. This influence arose from two events: the Market Street Development Project (a \$35-million beautification effort) and the adoption of new zoning regulations that permitted greater ratios of floor area to site area in buildings connected to BART stations or located near BART stations.

The effects of the advent of BART service on the distribution of office construction in San Francisco have been minor in comparison to the effects of market forces.

Four East Bay communities — Oakland, Richmond, Berkeley and Walnut Creek — have experienced increased office construction activity near BART stations, but on a much smaller scale. According to local observers, BART has played a limited role in these increases.



Distribution of new office construction in the BART counties. From the mid-1960's to the mid-1970's, the share of office construction in the suburbs more than doubled. At the same time, expenditures for new construction in the cities grew by 140%.

## 7 BART's Impacts on Real-Estate Markets

### Impacts on Residential Prices and Rents

The Land Use and Urban Development Project studied BART's effects on the prices of single-family houses standing within 200 to 2,000 feet of the BART station sites at Glen Park, 24th Street and 16th Street in San Francisco, South Hayward on the Fremont line and El Cerrito Plaza on the Richmond line.

While BART was being built, prices at Glen Park, 24th Street and South Hayward rose by 8% to 25% (adjusted for inflation). These price increases apparently were due to local expectations of benefits from the advent of BART service.

Prices at El Cerrito Plaza showed no change attributable to BART. The analysis of prices at 16th Street was inconclusive.

Since BART service began, the price premiums observed at Glen Park, 24th Street and South Hayward have disappeared. And in neighborhoods where BART-related traffic and parking have become nuisances, prices of single-family houses have been depressed by about 10%.

There has been no measurable decline in property values close to elevated or at-grade BART tracks.

BART's impacts on residential rents were studied at two places. Generally, rents have been unaffected. An exception might exist at Walnut Creek, where a statistical analysis detected local rent increases beyond those that could be attributed to inflation. This was the only result that suggested that renters might be willing to pay more to live in a community served by BART.

### Impacts on Commercial Property

Proximity to BART stations has influenced office rents in San Francisco, Walnut Creek and Oakland. (In Oakland, only the higher-priced commercial space was affected.) BART's impact was greatest in suburban Walnut Creek. It was smallest in San Francisco, where it virtually disappeared at 200 feet beyond a station entrance. In Walnut Creek, the impact was noticeable only after BART began transbay service.

Because data were scarce, sale prices of commercial property were investigated only in the Mission District of San Francisco. There, proximity to BART stations had had a substantial impact in the early years, when merchants were expecting BART to increase local walk-in trade. Since this expectation hasn't been fulfilled, BART's impact on commercial property prices has vanished.

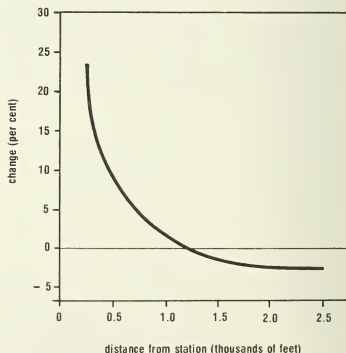
In general, real-estate appraisers and assessors consulted during the Land Use and Urban Development Project confirmed these conclusions.

### Impacts on Speculation

The Project defined *speculation* as the buying or holding of real property whose value was expected to increase because of BART's influence alone. This definition excluded investing in land for multiple purposes, even if one of those purposes was to reap gains through appreciation due to BART.

Most speculative activity took place when BART's stations were being built and expectations of improvements to be provided by BART were high. Speculation occurred in 13 of the 17 station areas studied, but nowhere did it involve large-scale purchase or holding of land. Rather, it focused on small commercial and residential properties. The level and type of speculative activity varied considerably from community to community: Downtown San Francisco, for example, experienced no speculative activity, while Oakland saw speculation in both commercial land and buildings. No consistent patterns were discernible.

Speculation diminished as BART's construction dragged on, and later as the inadequacies of its service reduced expectations of appreciation near its stations.



Property-price changes near the 24th Street station in San Francisco. From the early 1960's until the station was opened in 1973, the average price of residential parcels within 1,000 feet of the station increased, while parcels farther from the station depreciated.



## 8 BART's Regional Land-Use Impacts

BART's land-use impacts have arisen at the local level, rather than the regional level. BART has not increased population or employment in its three counties at the expense of the other counties. In fact, the Bay Area's most rapid growth has occurred in Santa Clara county, which is not served by BART. On the other hand, BART has helped to attract some employers into its station areas and into the narrow corridors in which 80% of all BART trips originate. These corridors have experienced faster growth of employment than have other parts of BART's greater service area.

Generally, sites within 1,500 feet of BART stations haven't experienced great increases in population, because BART was built to serve areas which were already developed. A few residential developers, having first selected a market area, considered BART in selecting a site within that area. But the land that they developed already was in the path of development. Hence BART hasn't measurably encouraged urban sprawl.

Changes in zoning or land-use plans have been implemented near 26 of BART's 34 stations. In most places, the changes favored less restrictive regulations — as when the maximum permissible height of buildings was increased,

or when commercial zoning replaced residential zoning in the area around a station. Most of the new development near BART stations has occurred at sites where less restrictive policies have been adopted. The table below shows this clearly.

BART has had no special land-use impacts on minorities. It has not encouraged the emigration of whites from the central cities, nor has it affected the movement of minorities to the suburbs.

	number of stations showing	
	new development	no development
new policy		
less restrictive	9	7
more restrictive	1	7
similar or unchanged	2	8

**Distribution of new development.** *This table relates new development to local changes in land-use policy that accompanied or followed the building of a BART station. New development occurred most frequently in station areas where less restrictive land-use policies or zoning had been promulgated.*

## 9 Interpretation

To date, BART has exerted more influence on shopping decisions, location decisions by households, location decisions by employers and other aspects of behavior than on land use and urban development.

On the local scale, BART's impacts are reflected chiefly by small increases in rents and property prices near some BART stations.

On the regional scale, BART has had no discernible effect on the amount of development, but it has affected the distribution of development: Development within the BART corridors is measurably different from what it would have been without BART. Even in the corridors, however, BART's impacts have not been as great as those that were anticipated. Some general observations on the nature of BART's impacts follow.

First: BART works with other forces to affect individual location and investment decisions that give rise to urban development patterns. In some instances, BART has affected redevelopment projects, urban beautification, and zoning changes. It also has been one of many

factors that have shifted private development from one local area to another.

Second: Though BART hasn't engendered major land-use changes (such as the construction of high-density housing in station areas), it might be opposing the decentralization of Bay Area industry and commerce in several ways: by improving access to San Francisco and Oakland, by demonstrating a public commitment to these cities, by facilitating the continued centralization of employment, and by supporting downtown retailing.

Third: Urban blight and other socioeconomic problems have worked against well-intentioned policies that sought to foster intensive development. This occurred in San Francisco's Mission District (around the 16th Street station), in downtown Richmond and in Oakland.

Fourth: Because BART has no entrepreneurial authority to conduct or promote land development, it cannot exploit the potential that it creates. But because BART enhances travel options in some areas, it might influence urban development over the long term.

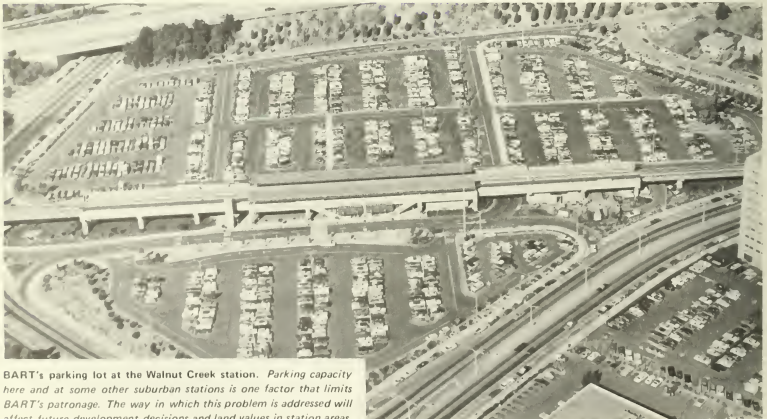
## 10 Expectations

If BART improves its service and reliability, its patronage will increase. BART then will have more effect on location decisions, and thus will promote demand for housing in its service corridors and station areas. But even if BART's patronage doubles, its effects on land use won't be as dramatic as those that were expected. BART will be only one of many factors that will shape land-use patterns, and the opportunities for change will be limited. BART'S most noticeable effects will occur near downtown stations and near stations that are surrounded by vacant land that is suited for development. In station areas that already are well developed, BART won't induce redevelopment unless other requisites also are present — requisites such as deteriorating structures, strong demand for commercial space and favorable zoning.

Within the constraints given above, various factors might modify or amplify BART's impacts:

- If the demand for multiple-family housing increases beyond its present modest level, it might accelerate the appearance of such housing in suburban station areas that are appropriately zoned. Vacant land in such areas might be developed sooner than it would have been if BART hadn't been built. It is unlikely, however, that any significant number of new, high-density residential buildings will be constructed near suburban stations during the next 5 to 10 years.
- Some commuters already prefer to live and to work near BART stations — even if they don't actually use BART — because BART provides an alternative to automobile travel. If more people adopt this view, areas served by BART will become increasingly more attractive than areas without BART service, and BART's long-term impacts on urbanization patterns will be amplified accordingly. This result will be promoted by any factors that increase the cost of automobile travel.
- Improvements in BART's service and in demand for suburban housing would promote BART's suburban patronage. The effects of a significant patronage increase on land use in the suburbs would depend on accompanying changes in access to BART stations.

If parking capacity at suburban stations were unchanged, demand for housing close to the stations would increase, the value of nearby land would grow, and higher-density residential and commercial development would be promoted. If parking capacity were increased, or if access to stations were otherwise improved, more people would be able to use BART while living at a distance from the stations. Higher-density development of station areas wouldn't be encouraged until station access again became constrained.



BART's parking lot at the Walnut Creek station. Parking capacity here and at some other suburban stations is one factor that limits BART's patronage. The way in which this problem is addressed will affect future development decisions and land values in station areas.

## 11 Implications for Other Regions

The BART experience has shown that a rail rapid-transit project can catalyze local planning and decision-making, and can promote various other public projects. BART has reinforced existing patterns of urbanization and has affected development within its service corridors.

These effects have been greatest where other factors have been supportive — factors such as zoning, land-use policy, demand for new development, land supply and public approval. In places where these factors have been unfavorable, BART's effects have been small or imperceptible. As a result, BART hasn't engendered most of the broad, regional effects that its planners envisioned in the early 1960's. Those effects would have required more supportive land-use incentives and land-use controls than the ones that actually have prevailed in most of the communities served by BART.

This finding and the others described in earlier sections of this report carry some important implications for other regions where rail rapid-transit systems are being considered:

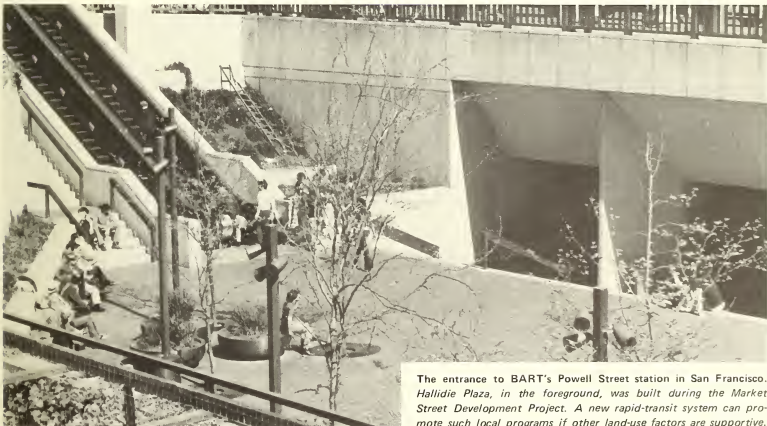
During planning and route-selection studies, local governments should work closely with developers, financial institutions and citizen's organizations. Planners and decision-makers should not expect any transit-oriented

development until after construction has begun. Most developers will wait for the beginning of service. In anticipation of this, related public improvements should be planned, funded and scheduled to minimize disruption and to support anticipated station-area development.

Expectations should be based on a careful analysis of demand, the availability of developable land, and the cost of such land. Unrealistic projections can jeopardize a project's success, sometimes with unfortunate fiscal consequences.

A value-capture policy — one that anticipates increases in property values near stations, and corresponding increases in property-tax revenues — probably won't yield substantial revenues during the early life of a rapid-transit system. Experience with BART provides little encouragement for financing plans based on such a policy. Generally, BART's effects on property values and rents in station areas have been positive but small.

To avoid the adverse effects of overflow parking, planners must design adequate parking lots for patrons who drive to rapid-transit stations in private automobiles; and they must provide adequate alternative means for reaching the stations, such as feeder buses. Both of these aspects demand attention early in the planning process. Limiting parking capacity to reduce costs is a false econ-



The entrance to BART's Powell Street station in San Francisco. Hallidie Plaza, in the foreground, was built during the Market Street Development Project. A new rapid-transit system can promote such local programs if other land-use factors are supportive.

omy. Alternatives include acquiring surplus space and using it for some other purpose until it is required for parking; building satellite lots or negotiating joint use of nearby shopping center lots, which would be connected to the transit station by frequent bus service; expanding feeder bus systems; and adopting regulations that discourage driving or on-street parking near stations.

Train noise should be considered during the writing of land-use and zoning regulations. The regulations might establish buffer zones along aerial or at-grade trackways that pass through residential neighborhoods. They might also require sound shields or other noise-mitigating measures. Routes along non-residential streets or within shared rights-of-way should be favored. Given the contemporary awareness of noise, the requirements of environmental

reviews and the restrictions imposed by noise-abatement legislation, noise impacts probably will be scrutinized more carefully during the planning of future rail systems than they were during the initial planning and designing of BART.

In suburban communities and residential neighborhoods, rail transit will not induce high-density housing around stations unless the demand for such housing is strong, building sites are available and appropriately zoned, and alternative sites are limited. If planners want to encourage station-area development, they should provide for a mix of housing within walking distance, accommodating couples, families and single persons. Housing options should include town houses, condominium apartments and apartments for rent.

## 12 Technical Literature

These MTC publications provide further information about the BART Impact Program and the Land Use and Urban Development Project. All of them are available from the National Technical Information Service (Springfield, Virginia).

### Reports by the Land Use and Urban Development Project

*The Impact of BART on Land Use and Urban Development: Final Report*  
Report No. DOT-BIP-FR 14-5-78

This is the final report of the Land Use and Urban Development Project.

*BART's Consumption of Land and Property*  
Report No. DOT-BIP-WP 55-5-78

*Study of BART's Construction Impacts*  
Report No. DOT-BIP-WP 48-5-78

*Study of Retail Sales and Services*  
Report No. DOT-BIP-WP 50-5-78

*Station Area Land Use*  
Report No. DOT-BIP-WP 39-5-77

*Study of Employers' Location Decisions*  
Report No. DOT-BIP-WP 46-5-78

*Study of Workers' Location Decisions*  
Report No. DOT-BIP-WP 38-5-77

*Study of Households' Location Decisions*  
Report No. DOT-BIP-WP 47-5-78

*Study of the Office Construction Industry*  
Report No. DOT-BIP-WP 12-8-77

*Study of the Housing Industry*  
Report No. DOT-BIP-PD 37-5-78

*Study of Property Acquisition and Occupancy: BART's Effect on Speculation*  
Report No. DOT-BIP-WP 45-5-78

### Other Reports by the BART Impact Program

*Environmental Impacts of BART: Final Report*  
Report No. DOT-BIP-FR 7-4-77

*BART's First Five Years: Transportation and Travel Impacts*  
Report No. DOT-BIP-FR 11-3-78

*Impacts of BART on Bay Area Institutions and Life Styles: Final Report*  
Report No. DOT-BIP-FR 10-6-77

*The Impact of BART on Public Policy: Final Report*  
Report No. DOT-BIP-FR 13-8-78

*The Economic and Financial Impacts of BART: Final Report*  
Report No. DOT-BIP-FR 8-7-77

*BART in the San Francisco Bay Area*  
Report No. DOT-BIP-FR 9-201-78

This is the final report of the BART Impact Program.



